IPS Virtual Paint – Sealing

Capability
- Realistic simulation of sealing material laydown including the complex rheology of the material
- Straightforward and intuitive simulation setup that require no expertise on computational tools
- Coupling to path planning software for optimization of complete robot cells
- Extremely robust, accurate and fast algorithms with immediate visualization
- Export sealing beads as CAD for packing and geometry assurance analysis

Benefits
- Power (detailed physical models and accurate results)
- Speed (apply one meter of sealing material per hour of simulation time, substantially shortened product preparation time)
- Easy to use (one day crash course, GUI tailored for the sealing process)

Results
- First software on the market
- Successful validation campaigns
IPS Virtual Paint – Sealing

- Automatically generated adaptive octree grids and immersed boundary techniques
- Fast solvers using GPU acceleration running on standard computers
- Accurate simulation of the sealing process from nozzle to target and free surface flow after impact

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- Air flow
  Reconstruction of the sealant in the air and prediction of impact on the target

- Surface flow
  Two-phase flow (sealant and air) predicting the free surface flow of the sealant after impact on target

- Geometry of sealing beads
  Visualization of bead geometry with powerful and intuitive post-processing tools
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## Simulation methods

### Physics-based simulation

**Accuracy**
Includes the most important physics of sealing laydown:
- Reconstruction of sealant flow through the air and impact on target
- Simulation of two-phase surface flow of sealant after impact

Accurate prediction of the sealing laydown for complex geometries and various process conditions

**High performance**
Runs on a standard computer and one meter of sealing bead can be simulated per hour

### Deposit simulation

**Very fast simulations**
Includes the reconstruction of sealant flow through the air and impact on target but does not take surface flow into account.

**Impact prediction**
Reasonable prediction of sealing bead especially in areas with high applicator speed

### Hybrid simulation

**Smart combination**
Utilization of the individual strengths of the physics-based and the deposit simulation method:
- Fast prediction of sealing bead with the deposit simulation method in areas with high applicator speed
- Accurate prediction with the physics-based simulation method for low applicator speeds

The switch based on applicator speed can be set by the user.

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Powerful and intuitive visualization and post processing tools

**Bead geometry**
The resulting sealing bead is visualized in each time step by a contour surface and may be exported in CAD format, to be used in e.g. a packing study.

**Computational grid**
Visualization of the automatically generated adaptive grid.

**Bead analyzer**
View the bead in its cross section and obtain quick estimates of the bead width, thickness and cross section area.
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Technical advantages

- Extremely robust, accurate and fast method with immediate visualization
- Running on standard computer
- Fully automatic mesh generation
- Process simulation and path planning in one environment
- Easy accessible simulation input
- Coupling to path planning software for optimization of complete robot cells
- No special know-how of meshing and advanced simulation software necessary. Training in one-day

Benefits

⇒ Saves days of simulation time and time for correcting wrong setup
⇒ Saves money for HW-resources
⇒ Saves man days of preparation
⇒ No co-simulation of different complex SW-tools
⇒ Fast simulation setup
⇒ Substantially shortened product preparation and cycle time
⇒ Ready for productive use in short time frame